Electricity Innovation Institute

STRENGTHENING THE PUBLIC/PRIVATE PARTNERSHIP FOR ELECTRICITY R&D

November 17, 2003

California Energy Commission
Dockets Office
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The Electricity Innovation Institute and the Electric Power Research Institute are pleased to provide comments to the California Energy Commission concerning Planning for California's Future Transmission Grid.

Please contact me with questions or comments at ellen@e2i.org or (650) 855-8939.

Sincerely,

Ellen M Petrill

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Planning for California's Future Transmission Grid

Comments of the Electricity Innovation Institute and the Electric Power Research Institute

November 17, 2003

Summary

The Electricity Innovation Institute and the Electric Power Research Institute ("E2I/EPRI") agree that California's transmission planning and permitting process needs to be addressed in the context of an integrated process that accounts for electricity demand and supply variations, efficiency gains, dependence on natural gas, and local reliability problems, as in San Francisco and San Diego. In addition, system-wide reliability and stability, and security need to part of the integrated and system-wide process. E2I/EPRI believe that transmission planning should unleash innovation through a stakeholder partnership process, not an adversarial process. Advanced technology and R&D should be considered, and transmission planning must be closely tied with the PIER transmission R&D program.

Introduction

The Electric Power Research Institute (EPRI) was founded in 1973 as a non-profit energy research consortium for the benefit of utility members, their customers, and society. Its mission is to provide science and technology-based solutions of indispensable value to its global energy customers by managing a far-reaching program of scientific research, technology development, and product implementation. EPRI is based in Palo Alto, California.

EPRI is the only science and technology consortium serving the entire electric industry -- from energy conversion to end use -- in every region of the world. With expertise in a wide spectrum of scientific research, technology development, and product application, EPRI is able to offer solutions that cut across traditional boundaries, taking advantage of the latest advances in many fields. EPRI has conducted research in the field of electric power transmission since its inception in 1973 and today continues to conduct a vigorous program of transmission research and development on behalf of it membership.

The Electricity Innovation Institute (E2I), an affiliate of EPRI, is a non-profit, public-benefit organization established by EPRI in 2001 to conduct strategic, breakthrough research and development in science and technology related to the electric enterprise, broadly defined. By bringing together public and private resources and perspectives, E2I and participating stakeholders support and direct science and technology innovation in electricity supply, delivery, and utilization to address the socio-economic needs of our future. E2I has a separate board of directors from EPRI made up primarily of individuals that have distinguished careers in public service. E2I is currently conducting related research on the transmission system of the future in its Consortium for Electric Infrastructure to Support a Digital Society (CEIDS).

The comments below represent the combined thoughts of both E2I and EPRI and are provided in order of the workshop agenda.

The Consultant Report: ***Planning for California's Future Transmission Grid, Review of Transmission System, Strategic Benefits, Planning Issues, and Policy Recommendations***

The report captures very well the California situation, the strategic investments to date, the benefits, and the value of the benefits, and makes recommendations that are valuable. Most importantly, we agree that a strategic vision and plan must be developed for California, and that it must be done in the context of the regulatory process and it must be coordinated with the other states of the Western region.

We recommend that the process for developing the strategic vision and plan should incorporate stakeholders, and importantly, in a partnership, not adversarial, format. Partners will brainstorm to develop solutions and ideas that build on ideas, so that each can benefit by win-win outcomes. Adversaries will typically not build new solutions, but remain fixed on their perspectives, resulting in win-lose outcomes. Partners enable innovation, adversaries do not. The stakeholders should include regulators, utility representatives, manufacturers, business, academia, and community representatives.

The strategic vision and plan should also be closely tied to the PIER transmission R&D effort, so that innovative new technologies and approaches are exploited, rather than simply relying on old technologies which are obsolete the moment they are installed and cannot address the needs of society in the future. Major investments in the transmission system should meet societal needs for decades to come.

Balancing the Need for Transmission Expansion with Regional and Local Land Use and the Environmental Concerns in a State Transmission Grid Planning Process

E2I/EPRI agrees that local issues must be addressed along with transmission expansion plans that may benefit far greater populations. As with the development of the state's strategic vision and plan for California's grid of the future, the process should exploit a partnership of stakeholders rather than allow adversarial win-lose battles to ensue. Furthermore, science and technology may allow for win-win solutions that adversaries would not consider.

E2I/EPRI recommends considering joint use of transmission corridors to alleviate problems of expansion. As a society we will be best served if we can consolidate as much utility into existing corridors as possible. This could include communications, such as fiber optic wire and cellular communications, and gas, water, and sewage. Of course, induced voltages and currents would need to be addressed, but the benefits are likely greater than the technical challenges.

Having generation near transmission allows for the development of the uninterruptible substation. Placing distributed generation at critical substations could help ensure reliable power even if the electric transmission is interrupted. Other uses for transmission

rights of way include roads, railroads, parks, and other public areas. The successful consolidation of transmission with communications, roads, and railroads, requires that electric and magnetic compatibility issues must be managed. Electric and magnetic fields (EMF) must be considered in order to include parks and public areas in the transmission corridors. EPRI has been a leader in the understanding of the health effects of EMF, and has developed numerous transmission designs that significantly reduce the level of magnetic fields at ground level from transmission lines.

Advanced transmission technologies are being used around the world and should be included in the planning process. Some examples include:

- Transmission line uprating (increasing the ampacity of existing lines). Increasing the capacity of the existing system can be achieved by enabling existing transmission lines and/or grid networks to operate at higher power flow levels, higher voltage stability, and with less line losses. This allows capital expenditures to be minimized and the need for new transmission siting to be reduced. Some examples of how this is accomplished include:
    - using solid-state, high power electronic devices to regulate the phase angle between the voltage and current sine waves, which controls the amount of real and reactive power in the lines.
    - operating closer to the line capacity at any given time through dynamic line rating tools.
    - replacing conductors with new materials with higher temperature operation and lower sag, which allows higher throughput with less risk.
- Transmission line upgrading (i.e. increasing voltage as opposed to up-rating which is the increase in ampacity). One of the most effective ways of increasing transmission capacity and reducing system losses is to increase the operating voltage on existing lines. This is singled out as an option because, while considerable attention has been paid to transmission line uprating, upgrading has received very little attention. While upgrading has been done world-wide a number of critical factors needs to be considered when using this approach. These include (live-line) maintenance, reliability, and electric and magnetic field management.
- Power electronics and flexible alternating current transmission system (FACTS): FACTS devices and power electronics controllers can add stability to the grid and they can distribute power more evenly across transmission lines, making sure less-frequently used lines are loaded, and highly-loaded lines are not overloaded.
- Lower-cost underground transmission needs urgent and focused attention. The migration path will be from a total overhead transmission system through to a mixture of underground and overhead transmission ending up with underground systems. Technologies that support this migration path are critical.
- Bulk Energy Storage: Bulk energy storage makes renewables much more adaptable to the system. They also can be used to flatten the load curve, stopping those nasty price peaks. They can also be used to ensure reliable power for critical customers.

- Superconductivity: this technology is being demonstrated in utility-scale applications, and can increase significantly throughput without increasing the transmission corridor.

Strategic Benefits Provided by a Properly Planned Transmission Grid

E2I/EPRI agrees that the strategic vision and planning process must articulate and quantify the strategic benefits of the properly planned transmission grid. To achieve the properly planned grid of the future must incorporate research and development results from a program closely tied to the vision and plan. New technologies may cost more initially, but the benefits far outweigh the initial costs. Several examples were given above.

Final Thoughts

E2I/EPRI commends the California Energy Commission for taking on the controversial issues with California's grid of the future. It must be done and it must be part of an integrated process of planning California's energy future. Innovation must be unleashed to provide effective, win-win solutions by exploiting stakeholder partnerships and a closely coupled R&D program.